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he must have the power to think straight and to give forceful utterance to his thought.

For the man that seeks to be a leader in the practical life of the world the study of the Humanities, of Greek and Latin, is to be recommended and urged, therefore, because of the thorough understanding and mastery of English that it gives; because of the discipline of the intellectual powers it affords, in determining the precise meaning of an author's discourse; because of the knowledge gained of the sources of our own language, our institutions, and our culture; because of the cultivation of taste that comes thereby in all that is high and fine in literature and art; because of the wider vision it gives to the spirit of men, and because it deepens one's sense of the continuity of culture, of the solidarity of the race, of our debt to the past, and so of our obligation to the future. It makes a man more a man, the more he knows of what men aforetime have borne and done and thought. The most practical man, in the final survey of human life, is the one that puts the emphasis on man and not on practical; who is never too absorbed in the cares and triumphs of life to ask himself soberly now and then: "What shall it profit a man, if he shall gain the whole world, and lose his own soul?"

IV. THE VALUE OF THE STUDY OF GREEK AND LATIN AS A PREPARATION FOR THE STUDY OF SCIENCE

HARVEY W. WILEY Chief of the Bureau of Chemistry, Washington, D. C.

In this twentieth century, when the world is full of men of affairs, when so much is accomplished in a material sense, when the intellectual power of certain men over their fellow-men is so marked, when our leaders are of such consequence, it is a matter of interest to study every phase of the training of young people, for they will be responsible for the progress we shall make in the future. All of us, teachers and students, workers in every line, are striving to make our work tell in the final result, and not one of us is willing that the precious time of the youth of this generation should be spent on studies that give no

value received at all commensurate with the time spent upon them.

In the general education, which all of us agree should precede the study of the science, art, or profession which is to be a person's life work, such good and broad foundations should be laid that later in life no trained man shall feel that his early training has been essentially defective. That much, at least, we older men owe to those coming after us, for we are supposed to have learned, by our experience as working members of this busy world, what parts of our education have given us the best training for the things we may have accomplished.

To estimate the value of the study of Greek and Latin as a preparation for the study of science, it is well to know what is thought on the subject by men of eminence in the various branches of science. If the matter is passed upon by chemists only, the conclusions to be drawn from opinions rendered would be very different from those to be drawn from the opinions of astronomers exclusively.

As a member of the Committee of Nine of the Classical Association of the Middle West and South, I sent a circular letter to one hundred prominent scientific men in the United States, teachers and others, for the purpose of eliciting information respecting their attitude toward the promotion of classical learning and their estimation of its value. This letter is in part as follows:

I particularly desire to present the matter of classical studies to the scientific men of this country with a view to securing more extended study of the classics as a basis for scientific studies. The great tendency in the past few years has been to eliminate any requirement of classical knowledge from courses in science. I hope that a careful study of these problems will lead to the return, at least in part, to former conditions of qualification.

I feel deeply that a man who proposes to follow a scientific pursuit especially should be well trained in both Latin and Greek. I do not mean that he should become a specialist, but that he should have such a knowledge of these languages as will enable him to appreciate their beauty and utility. I desire to have your views on the following points:

I. What value do you place upon a fair knowledge of the classical languages, especially Latin and Greek, as a basis for scientific studies and activity?

- 2. What practical utility may such a knowledge of the classical languages be to a scientific man in the active work of his profession?
- 3. What particular branches of science would be most benefited by such a knowledge?
- 4. What effect upon the style and clearness of expression will such a knowledge give to a scientific writer or speaker?
- 5. What practical help will such a knowledge be to the scientific man who is required to learn some modern language in addition to his own?
- 6. What effect will such a knowledge of the classics have upon the pleasures arising from knowledge rather than its application which may be enjoyed by an active, educated man?
- 7. At what age in a person's training should the knowledge of the classics above referred to be acquired or the acquirement commenced?
- 8. What effect would such a knowledge have upon the success of a scientific man in his professional activity?
- 9. Any miscellaneous or explanatory expressions respecting the value of classical study to scientific life and scientific research.

To this letter thirty-five replies have been received, of which the following is a tabulated summary, as regards the first eight questions:

Replies received35
Favorable to the study of Latin and Greek14
Unfavorable to the study of Latin and Greek17
Favorable to the study of Latin, but not of Greek4

Point 1.—What value do you place upon a fair knowledge of the classical languages, especially Latin and Greek, as a basis for scientific studies and activity?

No value 3
Very little value 4
All knowledge is of some value, therefore Latin and
Greek must have some value 2
Latin and Greek have little value in comparison with
the time needed to acquire a knowledge of them 3
Training in language is needed, but French and Ger-
man are better than Latin and Greek 3
Latin is valuable, but not Greek 4
Helpful 2
Great value
Essential 3

Point 2.—What practical utility may such a knowledge of the classical languages be to a scientific man in the active work of his profession?

No specific answer	4
No answer whatever	
Very little value	
Practical utility of Latin varies with the nature of	9
the science followed	
Some knowledge of Latin and Greek is of benefit	1
in making English scientific terms intelligible	4
Latin is of great value in obtaining a knowledge of	
the proper use of English, so necessary to any	_
educated man	2
A student of Latin and Greek really learns syntax	
while he is studying Latin and Greek. He could do	
this equally well by studying a modern language	
and better still by analyzing English authors	I
The value of Latin and Greek is the resulting acquaint-	
ance with English etymology	I
Severe attention to detail which the thorough study of	
Latin and Greek requires is of value, but strictly	
scientific studies might give the same result	I
The nomenclature and terminology of science are based	
on Latin and Greek, hence knowledge of them is	0
very important to a scientific man	8
Point 3.—What particular branches of science would be mos	t benefited
by such a knowledge?	
No specific answer	7
All sciences	
Astronomy	•
Biological sciences	
Botany	
Chemistry	-
Geology	•
Humanistic sciences	·
Mathematics	I
Medicine	6
Natural history	2
Natural sciences	I
Paleontology	,
Philology	1
Physics	I
Physics Zoölogy Zoölogy	I 2
•	I 2 I
Zoölogy	I 2 I

Note.—Several answers to Point 3 named more than one science. Several left the question blank. Point 4.—What effect upon the style and clearness of expression will such a knowledge give to a scientific writer or speaker? No specific reply 5 No influence 8 Often injurious I Tends to make the style obscure 2 Depends on personal peculiarities of the man; some Teaches grammatical precision I Training in English is better than training in Latin or Greek 4 Effect is beneficial 4 Knowledge of classical languages is very important to a scientific man to teach him how to use English with clearness and precision...... 8 Point 5.—What practical help will such a knowledge be to the scientific man who is required to learn some modern language in addition to his own? No specific reply 4 Effect will be to hinder the acquisition of a modern Any language training is helpful as a preliminary to other language training 2 A knowledge of Latin is of some value in the acquisition of French and Italian, but this is no motive for the study of Latin and Greek. Such a laborious and indirect approach to modern languages is wasteful in the extreme...... 6 A help in learning any Romance language......15 No help in learning German, the most important of modern languages to a scientific man...... 3 English is the best language to study as the basis for another modern language 2 Point 6.—What effect will such a knowledge of the classics have upon the pleasures arising from knowledge rather than its application which may be enjoyed by an active, educated man? No specific reply10 All knowledge gives pleasure; there is no special pleasure to be obtained from Latin and Greek classics..... 5 Much more pleasure is found in the great works in modern languages than in the classics in Greek and

Latin 5

A source of great pleasure	
Point 7.—At what age in a person's training should the know the classics above referred to be acquired or the acquirement com-	
No specific reply 8 Should not be acquired at all 1 After French and German have been acquired 2 If studied at all, begin as young as possible 4 Between 8 and 10 2 Between 11 and 20 3 About the age of 12 6 In the secondary schools 6 In college 2 Before professional studies are begun 1	
Point 8.—What effect would such a knowledge have upon the s a scientific man in his professional activity?	uccess of
No effect	

I select some typical replies to Question 9, giving them in full, since in many cases the attitude of the writer to the whole

subject under discussion is most clearly shown in his reply to that question:

J. M. BALDWIN, JOHNS HOPKINS UNIVERSITY

I think the attempt to continue so-called "classical" study in its traditional artificial position is quite useless and unwise. Let it take a place it can hold—one in common with other literary and linguistic groups of studies. To give it great importance in connection with science is a conceit, me judice, of its foster-parents.

R. P. BIGELOW, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

To summarize my opinions in the matter of scientific education, it seems to me that the essentials are of two classes: First, a thorough training in the use of the tools required by a scientific man, namely, the modern languages and mathematics; second, a training in the scientific method, especially as applied to the branch of science in which he desires to specialize. If to the curriculum, the study of the classics can be added without interfering with these essentials, then it seems to me that in some cases it would be desirable as a means of culture and enjoyment.

M. T. BOGERT, COLUMBIA UNIVERSITY

No reason for a scientific man to go beyond Caesar and Xenophon. Much more important for a chemist to be familiar with German than Latin, and Italian, French, or Danish than Greek. In fact, I would place the languages in about the following order for an organic chemist: German, English, French, Italian, Danish, Swedish, Latin, Greek, Russian.

G. C. COMSTOCK, WASHBURN OBSERVATORY, UNIVERSITY OF WISCONSIN

The value of the classical languages and their study appears mainly to result from the drill and mental exercise upon a host of constantly recurring small problems and the applications of flexible rules which the diligent student cannot escape, and which are especially adapted to the discipline of immature minds. The initial stages of such study appear to me of much more value for general training than anything which can come after the first three or four years of such work.

I. U. NEF, THE UNIVERSITY OF CHICAGO

I think everyone realizes as he grows older that he has his limitations. I, for one, regret very keenly that I took a great deal of Latin and Greek and did not spend far more time on advanced mathematics and physics. I am, however, not now wasting any time in vain or useless regrets on this account, but simply doing the best I can with the knowledge that I have acquired.

Ormond Stone, Leander McCormick Observatory, University of Virginia

The tendency to eliminate classics as required subjects from courses in science is pedagogically correct. Life is too short for everything.

Modern languages (at least German and French) are essential to the English-speaking man of science.

W. F. OSGOOD, HARVARD UNIVERSITY

I value linguistic training, and I believe that for the English-speaking person German offers all the advantages of Latin—not German crowded into a corner with Latin five hours a week for four school years, but German taught by the ear and by the eye, with thorough schooling in grammar and reinforced a year or two after the start by French, similarly taught, both languages strengthening each other through their comparative study. From such a study come the advantages, first, of the discipline, of the exact knowledge and the intelligent performance of a task well understood; second, of the broadening influence of wider human contact through really seeing something of the thought of other peoples; and, third, of having in our possession a useful tool for our science.

C. R. BARNES, THE UNIVERSITY OF CHICAGO

While I should advise every young man who is going to make a special study of some branch of science to study both Latin and Greek, I should greatly deplore *requiring* either. I do not think it possible to run every scientific intellect into the same preparatory mold.

FLORIAN CAJORI, COLORADO COLLEGE

Modern languages are indispensable. I have seen scientific men who could read their Virgil, but to whom a German book was a sealed book. Their scientific work was seriously hampered.

C. W. DABNEY, UNIVERSITY OF CINCINNATI

I do not know how a man can understand the terminology of science, much less keep up with its literature, unless he has a full knowledge of the classical languages. The scientific man must be able at a glance to know the meaning of all the terms used in science and I do not see how he can do this unless he has a moderate knowledge of Latin and Greek. He needs French and German to keep up with their literature and those languages are, in part, based on the classical languages.

E. S. DANA, YALE UNIVERSITY

I may say in general that my experience has shown that a knowledge of Latin and Greek is of great benefit to the scientific man, particularly in natural history, since without this he is ignorant in regard to the meanings of a considerable part of the scientific vocabulary, and if his work requires him to invent new specific names he has not the basis of knowledge to allow him doing this intelligently. Furthermore, the drill in Latin and Greek translations seems to me one of the best ways of studying the English language and thus training the individual in a clear style.

J. W. MALLET, UNIVERSITY OF VIRGINIA

But in a broader way such a one may well desire to have his share with his fellow-men in the mental strength and enjoyment which a moderate acquaintance with these tongues opens up in history, in literature, in art, and generally in a knowledge of the mental life of the chief races of men who have before us inhabited the earth. In the selection of subjects with which to fill the time and thoughts of the young during the part of life which can be given to formal training there must of necessity be close instruction within practically attainable limits, and the teacher must constantly keep before him the problem of what best may be *left out*, but in the so-called conflict between classical and scientific studies it may, I think, be truly said, "This should ye have done, and not have left the other undone"

B. OSGOOD PEIRCE, HARVARD UNIVERSITY

I do not regret the years that I spent in school and college (not very willingly at the time) upon Latin and Greek.

EDWARD RENOUF, JOHNS HOPKINS UNIVERSITY

Every scientific man knows what a dismal farce the result of classical instruction in the American preparatory school is, and I do not think it possible for classical instruction to scientific students to be prolonged beyond the second college year. The result obtained at that period, with the material the teachers have to handle, is still pitiable, and, to my mind, of little value, especially if it has lessened (as is usually the case) the time allotted to modern language. I cannot but feel that it is "up to" the teachers of classics. Scientific teachers starting with a freshman—about equivalent to entrance into Ober-Secunda of the Gymnasium—turn out an average undergraduate product which compares favorably with that turned out in German universities in the same working time from Real-Gymnasium graduates.

Why cannot the preparatory school teaching Latin to boys from 12 to 18 equal, or at least approach, the product produced between 12 and 17 by the classical *Gymnasia? When* they do, the questions on this sheet will not be needed—the man with classical training will be the only man who will be practically received as university or college teacher in science, as it is practically in Germany today.

C. O. WHITMAN, UNIVERSITY OF CHICAGO

I have long held that a good knowledge of Latin and Greek is quite essential to the modern man of science. In my own department, the ablest men are without an exception men who have had a thorough classical training. Those who have failed of this show it in inability to express themselves accurately and concisely. They do not have a fine appreciation of the primary meanings of words.

The scientific man must not only know how to use English, but also how to form new words for new purposes. Besides, his terminology is made up almost wholly of Latin and Greek derivatives. Over half of our whole vocabulary is founded on Latin. A knowledge of Latin aids immensely also in the learning of French, Italian, Spanish, etc.

The replies to the circular letter have been difficult to classify, considering each one as a whole. Examination of a letter often showed that different parts of it should be classified under different heads. I have endeavored, however, to separate them into two classes. First, those which upon the whole favor classical instruction; and second, those which upon the whole oppose classical instruction; but even with this clear-cut line of demarcation it has been found impossible to make a just distribution in all cases. Some of those which are found in class I will contain sections which should be placed in class 2, or vice versa.

The most prominent deduction from a study of the replies is the existence of two schools of thought based upon different premises or points of view. In the one instance there is quite a respectable element among scientific workers and teachers favoring decidedly, or in a limited manner, the requirement of classical instruction for the college degrees. This school believes, as will be seen in the detailed analyses given, that classical studies upon the whole are advantageous to those engaged in scientific work and also contribute to the enjoyment of scientific life. other hand, we may class those who are of the very positive opinion that all the time spent in learning dead languages, especially Latin and Greek, is wasted, and that the knowledge which the ordinary student obtains of these languages is not a working knowledge, nor is it of sufficient extent to warrant the belief that it adds anything to the pleasure or to the efficiency of those engaged in scientific pursuits. That such a difference of view would be secured was clearly foreseen. The surprise that has come to me in studying the replies I have received was produced rather by the large amount of testimony in favor of the classics than by that which is opposed to them. In general I think it may be conceded that in so far as actual utility is concerned in scientific research itself, a knowledge of the classical languages is not of any very great importance. On the other hand, in so far as nomenclature of science is concerned, especially biological science, a knowledge of Greek and Latin is almost Moreover, it seems to me there is a decided indispensable. opinion to the effect that a knowledge of the classics is more or less indispensable to one who claims to be a man of culture and education in the broadest acceptation of those terms.

In regard to the period at which classical studies should begin, the preponderating testimony is in favor of an early commencement. In other words, it is the opinion of most of those who have expressed any conviction at all upon the subject that a good knowledge of classical studies should be acquired during, or even before, the schooling which is designed to fit the young man to enter the freshman class of a good college or university. There is a very decided preponderance of opinion to the effect that the time of the more mature studies, that is of the last three years of the college course and practically the whole of the technical courses in scientific studies, should be free from any special devotion to classical researches.

I may cite as a typical advocate of classical learning the letter received from Professor Bessey of the University of Nebraska. He states in part:

In the management of the department of botany in the University of Nebraska, I require a knowledge of Latin at least, by those who take up the serious study of botany, and I urge such persons to have some knowledge of Greek also. The botanist must know something of Latin and he should know something of Greek also. One young man who came to me a number of years ago with a preparation in modern languages only, soon became so convinced of the necessity of a knowledge of Latin and Greek that after entering the University he went back to the beginning of Latin and brought up his knowledge of this language so that he became a critical Latin scholar. He did the same with Greek, and always defended his action on the ground of its being necessary for him in his botanical work. He is now one of the eminent botanists of the country.

As a typical illustration of the attitude of those opposed to classical learning I may give the letter received from Professor Carl Barus of Brown University:

It seems to me little short of ludicrous that anybody at the present age of progress should make an endeavor to reintroduce classical philology, particularly at a time when at such venerable seats of learning as Oxford and Cambridge determined efforts have been made to get rid of this incubus. How is it possible for anybody to fail to realize that the trend of science is ever toward mathematics, that in the next generation the demand for a mathematical equipment and the need of it will be increased

tenfold? How is it possible to ignore the fact that this is the direction in which specialization should be made, beginning at an early age, for the burden is continually heavier, and that this is precisely the direction in which nothing is being done. As for philological work, let us have English, French, German, Italian, etc., which not only have the same cultural value, but open to their possessors a world of life and learning and science. I can't answer your questions for they put me in a temper.

These two letters plainly join the battle between the opposing forces and in neither of them is there any uncertain sound.

Professor McKee, of Lake Forest College, sent a most interesting letter. He states that he is distinctly convinced from experiments he has made that classical studies are a positive disadvantage to scientific students. He finds that students who have come with a knowledge of Latin rather than with a knowledge of German do not rank as high as those who have studied German. This is not a mere opinion but is based upon actual data of the examinations of college students.

Professor Branner, of Leland Stanford Jr. University, does not agree with Professor McKee. He says:

I believe that a systematic examination of the records would show that the men who have the most enduring reputations in the science I know most about are men who have more or less training in the classics.

This may well be true, since the men who have enduring reputations are older men, and the older men were educated at a time when classical training was required and not made optional, as it is at the present time. Even, however, should the records of scientific men show in the future that those who have acquired distinction in sciences are those who have had no classical training, it would not be a proof of the lack of value of classical culture. It is well known that the taste for scientific studies often develops early in life to such an extent as to exclude all desire for the study of any languages, except those necessary to scientific reading and research. Hence it would happen that men with a natural bent for scientific studies would naturally omit the study of classical languages when such a study was not required for college graduation. Upon the whole, it seems to me that the class of data submitted by Professor McKee is likely to be the most reliable. Unfortunately for my own personal views in the matter, the results of his observations seem to be distinctly unfavorable to the classical scholar. I should not, however, like to rest content with this one instance, but should like to see it supplemented by others. If we think for a moment of the vast number of distinguished men who have already made their mark in science, and recall the fact that practically all of them were well trained in the classics, we would hardly be able to condemn classical studies on the ground that they are positively injurious, as is claimed by many of those who have responded to my inquiries.

My own opinion, partly formed, I must say, before receiving the replies to my circular letter, though somewhat accentuated by reason of these replies, is that it would be a very serious mistake to omit from the higher learning of the United States instruction in classical studies. I believe, on the other hand, that more attention should be paid to these studies, as was the case forty years ago, when it was deemed not possible to have a liberal culture without a knowledge of Latin. I believe that most of the objections to classical studies made by those who have responded to my inquiries would be removed if these studies were begun at an earlier age I am led to believe after many years of careful consideration of the subject, and as a result of four years of teaching the classics to young college students, and as the result of six years of instruction in the classics received from very competent teachers, that the failure to reach the full value of classical instruction lies essentially in the fact that this instruction is attempted at the wrong time and, to a certain extent, in the wrong manner. The general practice in this country is to defer classical studies until the time a young man begins to prepare for college. While there are many notable exceptions to this, exceptions that are, by the way, the strongest evidence of the pertinence of these remarks, I think it may be demonstrated that four years of classical study, beginning at the age of sixteen, as a rule, would produce no more mastery of these studies than would two or three years of study if commenced at the age of ten or twelve. Youth is the natural period for learning a language. In extreme youth the brain may be regarded as

almost unwritten upon and the sensations which it registers most indelibly are those which pertain to language. If the brain may be regarded as a palimpsest, I think we will all agree that the first inscriptions upon it should be those of language. Mathematics and science and philosophy can be written over words with good effect, but if you try to write a language over the other inscriptions you will have but little success.